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ABSTRACT

The three papers presented in this publication examines in depth the thought and practices that currently prevail in the specialized areas of reading and concept attainment. Two of the papers deal with concept learning and the transformation of this knowledge into instructional guidelines. The third paper considers the importance of concept attainment in reading and provides illustrations of teaching practices that should prove helpful to reading teachers. The teaching-learning factors involved are not only maturation and social interaction but also mental and physical action and the ability of self-regulation. References are included after each article. (This document previously announced as ED 024 558.) (BS)

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HIGHLIGHTS

OF THE PRE-CONVENTION INSTITUTES

READING AND CONCEPT ATTAINMENT

SEATTLE, 1967
INTERNATIONAL READING ASSOCIATION

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HIGHLIGHTS
OF THE
1967 PRE-CONVENTION INSTITUTES

Paul C. Berg
and
John E. George
Editors

READING AND CONCEPT ATTAINMENT

Russell G. Stauffer
Chairman of the Institute

INTERNATIONAL READING ASSOCIATION

Newark, Delaware

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FOREWORD

The Twelfth Annual Convention of the International Reading Association met in Seattle, Washington, May 2-6, 1967. The first two days were devoted to a series of institutes dealing with specific areas in the field of reading.

The following Institutes were held:

I. Bold Action Programs for the Disadvantaged: Elementary Reading
Chairman: Gertrude Whipple
Detroit Public Schools

II. Current Administrative Problems in Reading
Chairman: Thorsten R. Carlson
Sonoma Park College

III. Reading and Concept Attainment
Chairman: Russell G. Stauffer
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IV. Junior College Reading Programs
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Chairman: Gilbert Schiffman
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VI. In-Service Programs in Reading
Chairman: Dwane Russell
East Texas Center for Educational Services

The sessions represented by these papers attempted to examine in depth the thought and practice that currently prevails in these specialized areas. It is hoped that the reader will gain at least in small measure some of the inspiration and motivation that were produced by the sessions themselves.

Paul Conrad Berg
General Chairman

The International Reading Association attempts, through its publications, to provide a forum for a wide spectrum of opinion on reading. This policy permits divergent viewpoints without assuming the endorsement of the Association.

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INTRODUCTION

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PIAGET HAS REPORTED that work at the Center of Genetic Epistemology in Paris shows that the learning of logical structures is much dependent on a subject's ability to call upon other simpler logical or prelogical structures. If this were not true, nothing would be learned from the reinforcement. He says also that "...learning is always relative to the developmental period during which it takes place, and to the intellectual structures, whether completely or partially formed, which the subject has at his disposal during this period" (1, p. V). These ideas about learning can be transformed and applied to reading and not be misconstrued. If this process is done the quality of the "intellectual structures" of a reader assume great significance. In other words, cognitive functioning while reading or reflecting or testing hypotheses, to be most useful, must be directed by concepts that reflect real understanding.

Thoreau is reported as saying that "you will find plenty of meat, bread, and wine, at the Inn in Torchae, providing you bring it with you." The essence of this statement can be transformed also and applied to a reading situation. If the reader brings with him plenty of examined experiences of the physical world about him and plenty coherent experiences of a logico-mathematical kind, along with a constant sense of self-regulation and self-correction, then he will read at the highest level of usefulness.

On the other hand, the symbolic nature of written language provides stimuli that can evoke a high degree of "epistemic curiosity" (2, p. 254) and result in the acquisition of knowledge. Concepts can be and are attained by reading if children have an understanding of the intellectual actions and operations required.

It is for these reasons that knowledge about concept attainment at all levels and in response to different stimuli is essential if sound teaching practices are to develop children capable of proceeding with cognitive efficiency. These reasons are also why the pre-convention institute on Concept Attainment was planned and why it assumes high significance.

The three papers presented in this brochure provide a foundation for concept attainment that should prove helpful to all teachers of reading. Two of the papers deal with the learning of concepts and how this knowledge can be translated into instructional guidelines. The third paper considers the importance of concept attainment to reading and provides illustrations of teaching practices that can help a child enter into the kingdom of knowledge provided for him by the great thinkers. The teaching-learning factors involved are not only maturation and social interaction but also mental and physical action and the ability for self-regulation.

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1. Almy, Millie, et al. Young Children's Thinking. New York: Teachers College Press, Columbia University, 1966.

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CONCEPT LEARNING

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and
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THE LEARNING OF CONCEPTS is now regarded as an important objective in education. The learning and teaching of concepts are not so effective as they might be for three reasons. First, concepts have not been clearly defined. As a result, teachers and others do not know precisely what to teach as concepts. Second, learning theorists have not come up with clear explanations of concept learning. The course of concept learning cannot be predicted or controlled well, based on learning theory. Finally, the considerable knowledge from empirical research about concept learning has not been translated into instructional guidelines. The purpose of this paper is to consider these three matters.

The Nature of Concepts

Many people refer to a concept as an idea or abstraction and may, for clarification, give examples of concepts such as dog, numeral, sentence, and reading readiness. In line with the widespread practice of defining concepts by giving synonyms and examples, the preceding definition is acceptable for use with the general public.

Psychologists tend to define concepts operationally and also by giving verbal definitions and examples. For example, Bruner, Goodnow, and Austin (3) have defined a concept as

> ... a network of sign-significate inferences by which one goes beyond a set of observed criterial properties exhibited by an object or event to the class identify of the object or event in question, and thence to additional inferences about other unobserved properties of the object or event. We see an object that is red, shiny, and roundish and infer that it is an apple;... it is also edible, juicy, will rot if left unrefrigerated, etc.

Compare the preceding definition, based primarily upon a cognitive, information theory point of view with an operational definition by Kendler (7): "...a common response to dissimilar stimuli." The latter reflects a stimulus-response, behavioristic point of view.

When curriculum workers, scholars in the subject disciplines, and behavioral scientists consider which concepts should be taught and how they should be taught, more precise definitions are needed. Similarly, authors of textbooks and others who develop educational material require a more precise delineation of the concepts their material is designed to teach. Needed is a concept of concept, or a definition of concept, that specifies the criterial attributes or dimensions of concepts. Just as oranges and lemons are readily differentiated on the basis of four observable dimensions--size, color, shape, and taste--so also concepts should be differentiated from facts, for example, on the basis of specified attributes or dimensions. Concepts do have certain dimensions along which they can be differentiated from other learning outcomes. Klausmeier and Goodwin (8) listed some of these dimensions that are now treated briefly at a higher level of conceptualization.

Objective Definability. When scholars say that the knowledge of the discipline is mainly represented in concepts and statements of relationships among concepts, two assumptions are being made: first, the scholars can identify the concepts; and second, they can agree upon the definitions of the concepts. The objectivity with which concepts are defined varies as does the basis of the definitions. The two are not independent, as will become apparent.

Some concepts are defined in terms of their dimensions or attributes. These dimensions or attributes are abstracted as being alike or the same in otherwise dissimilar objects and thus define the concept from an objective point of view. As indicated earlier, the attributes which allow some objects to be classified as oranges and others as lemons are size, color, shape, and taste. Similarly, the attributes useful in defining or putting many objects into the two classes, squares and equilateral triangles, are number of sides and length of sides. Plants, animals, and nonliving things and conditions have been studied by naturalists and scientists; and on the basis of their observed attributes have been given names, assigned to classes, and organized into taxonomic systems--for example, the animal kingdom, the plant kingdom, the solar system, and the table of chemical elements.

Concepts may also be defined operationally. There is a tendency in the behavioral sciences to define concepts operationally, in part because the phenomena dealt with either do not have intrinsic attributes or the attributes assigned to the phenomena by various scholars are not mutually acceptable. Previously, one definition given of a concept was "a common response to dissimilar stimuli." This

is an operational definition. Here are other examples of operationally defined terms: "Intelligence is a trait of individuals as measured by a test of general intellectual ability." "Hunger drive is an internal condition of the animal expressed as a linear function of the amount of time elapsed since food intake." Operational definitions are precise but tend to vary according to the operations carried out under specific conditions. For example, the intelligence of the same individual may vary markedly according to the different tests of general intellectual ability. Psychological scientists do not agree upon the attributes of intelligence.

Conceptualization also proceeds on the basis of the use of the objects. For example, corn oil, strawberries, and beefsteak vary markedly according to intrinsic properties, but all are categorized as food. Definition of concepts in terms of the use made of objects and ideas is generally more tentative and culturally-bound than is definition in terms of intrinsic properties. For example, more people properly classify pigs and cows as animals than pork and beefsteak as food.

In the preceding paragraphs we have seen that concepts, as represented in words or other symbols, may be defined in terms of the observable or measurable attributes that inhere in objects or conditions, the identifiable relations among phenomena, and the uses made of objects and ideas. It is not the purpose here to treat the certainty of knowledge in various fields in terms of the methods used for defining concepts. Rather, the point is made that concepts vary on the dimension of objective definability; experts who know most about a discipline can probably indicate the main concepts of the discipline and also arrange them according to preciseness of definition.

Structural Characteristics. Four important considerations concerning the structure of concepts are the nature of the attributes that comprise the concept, the rules by which the attributes are joined to form the concept, the number of attributes or other items joined, and the manner in which the concepts may be represented.

Think of the concepts represented by the words red, mammal, baseball strike, and older. They differ in the number of attributes and the rules by which the attributes are joined. Red is a simple, affirmation-type concept comprised of one dimension. Animals that manifest three attributes simultaneously or conjunctively--warm-blooded, mammary glands, bear young--are classified as mammals. A

..trike in baseball represents a concept where attributes are joined by a disjunctive rule--and/or. A strike may be a ball thrown in the strike zone and called by the umpire, or it may be a pitch swung at and missed, or it may be a foul tip. A five-year-old child is older than one of four years but younger than one of six. This is a relational type concept. These are not all the rules for joining attributes in forming concepts and in joining simple concepts to form more complex concepts. Also, the applicability of the conjunctive, disjunctive, and relational rules to the various school subject matters is not established fully.

A second way to look at the structure of concepts is in terms of what is joined, rather than the rules for joining them. Think of the letters of the alphabet as units; of words like fish and fruit as representing classes; of words being joined into sentences by syntactical rules to express relations; and of relations being joined together in paragraphs to comprise systems that may be useful in describing, explaining, and the like. As one goes higher up the scale from units to classes to relations, the concepts become more complex. Being joined eventually are concepts into more complex concepts that some persons call generalizations, principles, or even theoretical statements. This result in no sense denies that what may be a class in one scheme is a unit or a relation in another.

The number of attributes comprising a concept varies widely. Colors such as red and blue have only one dimension. Mammals have many attributes. Many subconcepts may be joined and relationships expressed among them, for example, in the system by which vertebrates are put into various subclasses. In general, the greater the number of items joined, the more complex (and difficult to learn) is the concept.

The attributes of concepts may be represented in words or other symbols as is being done in this paper. Some attributes may also be observed directly in figural content; that is, they may be seen or heard as they actually exist. Some may also be manipulated or acted upon physically. Much remains to be learned about the extent to which the attributes of more complex concepts and relationships among them can be expressed graphically rather than symbolically. Also, study is needed of the extent to which models can be constructed that permit the manipulation and observation of attributes, especially the attributes of process concepts.

In summary, the structure of concepts and of knowledge, generally, is determined by the nature of the attributes or

the subconcepts, the rules for joining them, the number of attributes or subconcepts joined, and the manner in which the concepts are represented. Concepts comprised of one attribute only and represented physically are least complex, or difficult, and may be learned early in life. Concepts comprised of several subconcepts that in turn represent systems, that are joined by disjunctive rules, and that are represented only in words or other symbols are most complex.

Psychological Meaningfulness. Experts in a subject field might agree about the definability, structure, and other dimensions of many concepts in the field. This agreement, however, would not indicate that all individuals possess the same concepts. Thus another dimension of concepts is individual, or phenomenological. Here there are two main concerns--differences regarding the same concept among individuals and changes within the individual regarding the same concept that occur with increasing maturation and learning.

Individuals of the same age vary widely in the accuracy and completeness of their concepts. For example, first-grade children's concepts of reading, school, and time vary considerably as a result of differing environmental and biological factors. Similarly, there is great variability among teachers' concepts of reading readiness, individualization of instruction, and pupil-teacher planning. Differences among individuals in the accuracy and completeness of concepts are well documented.

Children's ability to conceptualize changes with age. According to Piaget, the changes are qualitative; that is, at successive stages that can be very roughly identified with age, distinct changes occur in the kind of mental operations that children can perform.

Bruner has transplanted Piaget's ideas, developed in Europe, to the American setting. According to Bruner, the growing human being has three means of acting upon his environment: through direct action, through imagery, and through language. Individuals not only act upon the environment through these means but have appropriate internal counterparts in the central nervous system for representing sensory-motor acts, percepts, and thoughts. These internal representational schemes are designated enactive, iconic, and symbolic. In early life the child proceeds in this sequence. He apparently first acts upon objects, or manipulates them (enactive representation) before developing a mental image (iconic) of them, and then later he associates names with the objects (symbolic). Although this sequence

is typical of early life, one does not stop transacting with the environment through action and imagery. These continue throughout life. However, with the development of language, one increasingly deals with his environment at the symbolic level.

Like Piaget, Bruner (2) states that enactive and iconic representation are characterized by immediacy. Objects and events in the immediate environment are represented in the cognitive structure. With language development comes the ability to represent experiences in words. This act in turn releases one from immediate transactions with the environment. Language also permits combinatorial mental operations in the absence of what is represented. Thus, higher-order productive thinking is possible and enables one to interconnect and organize experiences into increasingly inclusive and abstract hierarchies.

Utility. Of what value is it to have learned a concept? Bruner et al (3) have outlined five uses or functions of concepts. First, concepts serve to reduce environmental complexity by allowing classification into superordinate categories. Second, concepts are means by which environmental objects and events are identified. Third, concepts reduce the necessity of continual relearning by providing easily recallable class labels. Fourth, concepts provide direction for instrumental activity. Fifth, concepts permit ordering and relating classes of objects and events.

Not all concepts are equally useful, not equally applicable to many situations. As pointed to previously in the discussion of structure, concepts can be ordered hierarchically according to the number and type of attributes that are joined, the rules for joining them, and the mode in which they are represented. Concepts higher in the hierarchy function in more situations than those lower in the hierarchy. For example, the concepts of plant and animal function in more situations than do those of tree and bird, respectively.

Theoretical Viewpoints About Concept Learning. Most learning theorists in the previous decades have defined concepts in terms of only one or two of the dimensions of concepts previously discussed. More recently, many individuals are studying concept learning in depth. A brief consideration of theoretical viewpoints about concept learning is essential prior to dealing with principles of concept learning.

S-R Viewpoints. Stimulus-response psychology has long been accepted as a scientifically acceptable framework in which to analyze human and subhuman behavior. Numerous

theoretical viewpoints about concept learning have arisen from the stimulus-response or behavioristic tradition. Furthermore, each viewpoint is in itself an extension, or in several cases a subtheory, of a more comprehensive theory of behavior. Consequently, among the S-R viewpoints one finds agreement concerning two basic assumptions: first, concept learning is a complex but basic learning process; and second, explanations of simpler kinds of learning provide adequate explanations of concept learning. Among the many S-R viewpoints, brief attention will be given to Hull, Skinner, and mediation.

Hull (5) defined a concept as an abstraction of an element common to a group of stimulus situations resulting from a multiple discrimination process. This process of abstracting was thought to occur primarily as a result of the trial-and-error pairing of the common element in the stimuli with the labeling response. The strength or probability of occurrence of the labeling response was assumed to be a function of the number of times it was paired with the common element. Hull showed that concept labels were conditioned to common stimulus elements and that this process occurred without active intervention by the responding organism. Hull's conclusion was probably valid for the simple concepts his subjects attained and the conditions under which they attained them.

Skinner (9) reinterpreted Hull's conditioning theory in several important ways. According to Skinner, if reinforcement (or reward) follows as a consequence of some response by an organism, all the stimulus elements effective at the time of reinforcement acquire some control over that response. Stimulus control is assumed to increase as a function of the number of previously reinforced responses. Conceptual behavior is assumed to occur when these elements appear and are responded to within a variety of dissimilar stimulus patterns. The result of this process is defined as an abstraction, concept, or universal depending upon the generality of the referent.

Both Hull and Skinner ascribe little activity to the organism except the possibility of forming associations and memory traces. The response is seen primarily as a function of external stimulus conditions. Neither viewpoint postulates covert thought processes. Learning proceeds as a result of the mechanical connecting of environmental events and the responses to those events.

It is possible that some part of our concept learning behaviors can be explained on the basis of simple mechanistic

associations. For example, making simple motor responses to certain environmental events, discriminating among objects, and associating labels with environmental events may be explained by S-R concepts. Further, learning simple concepts of affirmation, such as redness, may be explained by S-R principles. The concept of redness is embodied in physically observable stimulus properties. The response, red, to the observable properties may be acquired through S-R principles of association.

As noted before, the structure of concepts varies as do the bases for defining concepts. Some concepts are defined on the basis of use, not on the basis of observable dimensions. For example, a saw, hammer, and level do not have observable common attributes. However, each is a hand tool to be used in constructing things. Obviously, learning this kind of concept requires more than simply giving the same response to the observable, common properties of the three stimulus objects.

The preceding type of analysis has led to hypothesizing internal mediational processes or internalized cue-producing behaviors. Mediation is postulated as including internalized representational responses which function as cues for the final response. It is the association between the self-stimulated cue and response which is responsible for the term, mediation. The problem, however, is to discover the exact nature of the mediator. Kendler and Kendler (6) consider mediators to be words that represent concepts; they assume a regulatory function over overt behavior. The extent to which behaviors are controlled by implicit speech is a direct function of age. As age increases, implicit verbal control over overt behavior increases, suggesting that mediation of stimulus-response events increases as the child acquires a larger number of concepts.

S-R mediational theorists have proven to their satisfaction that people can think and operate on their environment in accordance with thought processes. The mediators may be words representing concepts or they may be more complex intermediaries such as instructions or strategies. All can be inferred from overt responses or behaviors.

Hypothesis-testing Theories. Hypothesis-testing viewpoints draw upon information processing models mainly and, to a lesser extent, mediational viewpoints. In addition, concept learning is assumed to be a highly active process, a series of seeking behaviors rather than passive responding behaviors. Representative of this approach is the work of Bruner et al (3), who treat concept learning as active

decision making. Decisions are based primarily upon two kinds of information: first, the information contained in the immediate environment and, second, information which the person brings to the task. During concept learning the learner is presumably seeking attributes and constructing hypotheses or statements about the possible relevant dimensions or properties that define the concept. An incorrect hypothesis concerning what the concept is requires simply a reformation of the hypothesis. Consequently, conceptual behavior, in general, is viewed as an active, sequential, decision-making activity in which later decisions are based upon earlier ones. The individual seeks to identify the attributes and rules comprising the concept, rather than passively responding to stimulating events.

The S-R and hypothesis-testing viewpoints have been presented as greatly different. The writers hold the viewpoint that individuals acquire some simple concepts according to S-R mediational principles and some according to hypothesis-testing principles. Individuals are not, for extended periods of time, either passive responders or active searchers. Further, how the environment is structured is an important determiner of amount of activity.

Principles of Concept Learning

The previous comments suggest that concepts are essential for transmitting man's previous experiences from one generation to the next, for interpreting and simplifying elements of current situations in which the individual finds himself, and for projecting plans into the future. Concepts are the content of thought; they are manipulated in thought. From laboratory experiments, theory of learning, research on concept learning in school settings, and from experience in teaching, one may infer a small number of principles or guidelines to be followed in teaching.

1. Establish the correct language or labels for the concept and the attributes.

Labels for concepts and labels of attributes are probably spoken by most children before the concept itself is learned. For example, in attempting to teach a child the concept of flat, the parent or teacher probably points to a number of surfaces that are flat and says "This is flat" or introduces each instance with a question such as "Is this flat?" The teacher assumes that the word is already in the child's speaking vocabulary or, if not, that he can readily speak it. Similarly, in teaching the cardinality of two, the label or word is probably in the child's vocabulary before the teacher

points out sets of objects in two's or asks the child to identify sets of two. While one may perhaps assume that children have acquired a speaking vocabulary on which to base a considerable amount of subsequent learning of concepts, one should not make the same assumption about the child's ability to read the labels or words. It is possible that mathematicians and others do not give enough attention to the reading problem or even to the speaking problem connected with the terminology in which mathematical concepts are stated. Here are some of the concepts given in the glossary of a third grade arithmetic book: fraction, geometry, partitioned, quotient. Teachers should not assume that all or most third-grade children can read these words or even have them in their speaking vocabulary. One must recognize that if the child cannot read the words, he cannot acquire the concepts by reading and studying the book.

2. Emphasize the attributes of the concepts to be learned.

As one examines textbooks and also classrooms, it is apparent that the teaching of concepts relies very heavily on the use of examples and verbal definitions, usually in the form of synonyms for the word. It is possible that children, by studying the examples, do not always identify the attributes that really comprise the concept.

Suppose that one wishes to have children attain concepts of triangles and squares. One could present three instances or examples of equilateral triangles of the same size and three instances of squares of identical size. Children at a certain developmental level would readily put the three identical triangles in the same pile and the three squares into another pile. How effective would this arrangement be in helping the children to identify the criterial attribute, number of sides, in the concept of triangle and square? One cannot be certain. However, the number of sides may not be noted as the criterial attribute for defining triangles and squares. A different procedure might work better. One could present three equilateral triangles of small, medium, and large size and three squares of different sizes. The number of sides would be more obvious and the child might not treat equal length of sides as the criterial attribute.

Little disagreement has existed in the past concerning the usefulness of arranging instructional activities so that students can directly observe instances of the concept. For example, field trips are taken to the turkey farm, the evergreen forest, and the museum. Specimens are brought into the laboratories. These sensory experiences with instances or specific examples of a class have been shown to be helpful

in concept learning. One has, however, recently gone beyond this elementary level of thinking. One now tries to identify the attributes by which things are classified. Rather than going to a turkey farm to see hundreds of turkeys, only one class of domesticated fowls, instead pictures of turkeys, hens, geese, and ducks are shown. The latter activity provides better opportunity for cognizing likenesses and differences among members of the same class and of the four classes.

In another regard, there is movement beyond merely providing direct experiences with the actual objects or even pictures of them. Actual objects and pictures often include details that are distracting, that prevent cognizing the attributes which are the basis of differences and likenesses. If someone brought a live snake and a snail into the class for the purpose of discriminating between reptiles and mollusks, the distractions would keep many students from learning the differentiating attributes. Drawings or animated moving pictures in which only the differentiating attributes are clearly shown are more helpful in establishing the desired concept. Considerable evidence is mounting that too much detail in audiovisual material is distracting and hinders efficient learning.

For many concepts instructional activities can be arranged in which the attributes stand out clearly. Perceptual experiences with instances of the concept are especially helpful to younger children, because they lend reality to the words in which the concepts are expressed. Even with mathematical concepts embodied in numerals and words, one would do well to use drawings, diagrams, and manipulatable objects in which the attributes stand out rather than merely to present instances or representations of the concept. Knowing the attributes of the number system, not only being able to give examples, is the mark of meaningful concept learning.

3. Provide for proper sequencing of the instances or examples of the concept.

The younger the child the more important it is to have sensory experiences with instances or examples of the concept. Concrete objects and models must be used rather than words or other symbols alone. In addition, these instances must be put in a proper sequence for learning. We have little knowledge as yet about the proper sequencing of instances of usual school subject matter based on research in school settings. However, information has been found about sequencing over a short period of time from laboratory experiments. The next ideas have been extrapolated from the laboratory research to the classroom and must be interpreted

with caution.

a. The greater amount of irrelevant information presented along with relevant information, the more difficult it is to attain the concept. An analogy to the classification scheme in zoology may again be appropriate. In teaching the concept of mammals, a teacher could present instances of vertebrates, including small numbers of mammals and large numbers of non-mammals. Pictures of bears, chickens, and fish might be used. While each of these instances would have at least one characteristic of mammals--namely backbones--the students would not learn very efficiently just what a mammal is. The presentation of a larger number of instances of mammals and fewer instances of non-mammals would be more appropriate and efficient.

b. Attributes of high dominance or obviousness are observed more readily than are those of low dominance. A high dominant attribute stands out clearly from a low dominant one; it is discriminated more readily. On the printed page, for example, the large upper case letters are probably more dominant for most people than is any word on the page. Similarly, the number of sides of a geometric figure is probably more dominant than is the length of the sides. Exactly how to make attributes of the concept more obvious is an art, one that teachers might try to develop.

c. A simultaneous presentation of instances of the concept is more effective than a successive presentation of instances. Proper account must, of course, be given to the developmental level of the student. In general, presenting several instances of the concept simultaneously permits discrimination of the attributes more readily and also reduces the memory load. If a child is presented six triangles of varying size and shape simultaneously, he can observe the criterial attribute of number of sides better than if he dealt with them one at a time.

4. Encourage and guide student discovery.

In recent years there has been a marked trend toward so-called "discovery learning." The University of Illinois Committee on School Mathematics (1), the School Mathematics Study Group (10), and the Chemical Education Material Study (4) have all given emphasis to the preparation of textbooks, films, and other instructional material in which the attempt is made to have students discover generalizations and concepts. Millions of dollars are going into the preparation of instructional materials and methods which supposedly will assist students in discovery. These programs, however, in no

sense intend for the student to proceed without instruction. At least three features are usually incorporated into these and other programs: 1) bringing to the students a problem that is real and meaningful, 2) encouraging and guiding students in gathering information, and 3) providing a responsive environment in which students get accurate feedback promptly so they can ascertain the adequacy of their responses. Further, the attempt is made to sequence the printed instructional material so that students are guided into arriving at the correct concept or generalization.

When these procedures are carried out, the instructional environment is highly controlled; students are not permitted to discover and accept wrong answers. It is entirely possible that encouraging the student to raise questions and to find his own answers increases motivation for learning, and it may also facilitate initial learning, retention, and subsequent use of concepts.

To clarify what is meant by guiding the discovery process, does giving students some information about the structure of subject matter or about a strategy or a principle to use in securing information facilitate concept learning? The answer to these questions is in the affirmative. Also, giving students information about a principle for arriving at answers to problems and for understanding material has had a uniform history of securing better initial learning than having the students proceed completely independently.

The varying degrees of direction result in more efficient initial learning, retention, and subsequent use under certain conditions, but these require more study. The previous knowledge of the student, his previous strategies or methods of learning, his attitudes toward independent learning, the subject matter field, the general climate for learning in the school, and the methods of the teacher, all are related to the extent to which freedom for independent discovery operates effectively.

The teacher's encouragement of a questioning or searching attitude on the part of students is conducive to their acquiring new concepts and to broadening partially developed concepts. A final balance is required between giving too much information and direction and giving too much freedom and responsibility. How much to help, when to help, and in what way to help require decision making by the teacher in the immediate situation.

5. Provide for the application of the concept.
A number of principles have already been stated for

facilitating the learning of concepts. These principles are themselves a complex form of concepts that can serve as guides to behavior in teaching-learning situations. On these pages they are merely batches of ink. Read aloud, they are merely puffs of air. One could memorize the principles without getting the meaning intended. To be sure of understanding the principles, one must try to apply them. Similarly, the best test of whether children understand a concept is to ascertain if they can apply it. Giving aid with applications, as has been done through various examples, should be helpful.

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TWO PROCESSES OF CONCEPT FORMATION: ASSOCIATIVE AND DEDUCTIVE

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THE FOUR MAIN STREAMS of the recent studies of concept learning fall into relation when concept learning is viewed not as a single process but as a dual process. The two processes which the writer first described in detail in 1958 (Podell, 1958) are the associative and the deductive hypotheses. To give an example of how they interact in a simple concept formation situation, consider how a child might acquire the concept dog from a series of experiences with or pictures of different kinds of dogs. When the series is begun, the child observes one picture of a dog, a dachshund. Any characteristic which he happens to notice on the basis of that dachshund will to some degree be assumed characteristic of the more general class dog. These characteristics are thought to be associations to the particular instance of the concept and are determined by factors such as the perceptual distinctiveness of the various features, his set or expectation when he observes the particular picture, and the prior associations he has learned and the way in which they are organized by his recent experiences.

In small children, the continued occurrence of some of the same associations to different instances strengthens the association between these associations and the concept name, dog, or in more general terms, becomes the essence of the concept dog. In older children, however, these associations could be used as hypotheses. That is, hypotheses concerning the essential features of the concept are formed from these associations, and the question of whether the conditions are necessary, on the one hand, or irrelevant to the concept, on the other, is then tested in that the subject (S)deliberately notes whether the hypothesis is confirmed or disconfirmed on successive instances of dogs or non-dogs. Thus, there are, at least in relatively mature children and adults, two processes, the one being an associative process which provides the basis for the other, the deductive process. But all individuals, regardless of maturity, can and do form concepts on the basis of the associative process alone while only relatively mature Ss have learned to test hypotheses. Evidence for the fact that hypothesis testing is employed to a greater extent with more mature children is apparent from

some of the research reported here and from the work of Osler & Fivel (1961) and Osler & Trautman (1961).

The four main streams in the concept formation literature are the developmental studies of Inhelder and Piaget (1958), including the recent work by Bruner and his associates (1966); the studies of reversal shift by the Kendlers and others (1962); the studies of deductive reasoning by Bourne (1966), and Hunt; the early studies by Bruner, Goodnow & Austin (1956); and the studies of associative concept learning by Underwood and his students, Underwood (1957), Underwood & Richardson (1956), and Mednick (1962). The writer's work tends to crosscut some of these themes and serves to integrate the theoretical approaches which are implicit in or proposed on the basis of the experimental work which has been conducted by the particular groups.

Piaget and his followers have, for the most part, set up situations which will display the child's comprehension of his physical world and will enable them to describe the way in which the child organizes his perceptions and motor responses in relation to that world. Thus Piaget's system is largely descriptive of what the child already knows and what he can learn directly, coupled with a theory about the development of cognitive structures. Piaget's stages are mainly descriptive of the kinds of concepts a child can acquire and does employ at a given age level. For instance, in the earliest stage, called the sensory motor or preverbal stage (lasting to 18 months) the child acquires the concept of object permanence. That is, even when an object is no longer perceived, the child learns that it still exists perhaps behind the screen or inside the bag. In the second stage, characteristic of the child from 2 to 7, preoperational representation, symbolic functions emerge involving the beginnings of thought and language which may be derived from, but not completely reflecting immediate sensory experience. On the whole, however, the child's conceptualization is perceptual-dominant and characterized by a tendency to classify mainly on the basis of physical similarity although his classifications are often primarily egocentric. The third stage of concrete operations which occurs in children seven to eleven years of age entails the occurrence of certain reasoning operations, especially reversibility as demonstrated in simple arithmetic, classification which entails hierarchies of classes, and seriation which entails arranging items along a continua of increasing value or magnitude. The final stage, formal operations, occurs in children from eleven to fifteen years of age. In this stage true abstract thinking emerges as well as the ability to think in a logical deductive manner, involving the creation and test of hypotheses

and the deduction of logical conclusions. The content of Piaget's description of the development of concepts in the child deals mainly with the acquisition of concepts about the physical world but does emphasize the kind of mental operations that the child performs. From the point of view of the two-stage analysis of concept learning, it might be said that the child traces the emergence of logical reasoning but does not deal directly with associative functioning. Inhelder and Piaget (1958) maintain that a child progresses from one stage to the next in a fixed order although a given child may show evidence of functioning in more than one stage with tasks of different difficulty. Furthermore, they believe that there is relative homogeneity of function within a stage. However, Smedslund (1961) succeeded in teaching children conservation of weight but could not teach them transitivity by a similar method. Even more to the point, Beilin (1965) was able to train children on two conservation tasks, the one involving length and the other involving number, but this training did not transfer to a third conservation task, conservation of area. It is also of interest that giving kindergarten children the verbal rule facilitated their learning, but their own ability to verbalize the conservation principle correctly was not clearly related to correct performance.

These facts are at variance with Inhelder and Tanner (1956) who maintain that a stepwise and fixed order of cognitive stages exist despite the fact that they now admit that an operation-like conservation may not be achieved in all realms simultaneously, probably because some physical parameters are more difficult to deal with than others. The Geneva group is also of the opinion that verbal processes should only affect logical thought after the development of nonverbal schema have occurred, an opinion contradicted by Beilin's evidence. Although the work of the Geneva group will not be considered in any detail, it must be mentioned that the major cognitive function which they believe accounts for concept formation is accommodation, a process whereby the schema or repeatable pattern of behavior, which may include a system of ideas, changes to incorporate or accommodate incoming information. The alternate process, assimilation, involves changing the incoming information to fit existing schema, and both processes work to achieve some sort of equilibrium. It might be mentioned that although no mention is ever made of associations, it is possible to formulate their theory in associative terms to account for the way in which cognitive associative organization affects and is affected by experience.

The work by Bruner and his associates at Harvard, recently

published in book form (Bruner, Olver, et al, 1966), can be grouped with the Geneva group in that many of the theoretical propositions they pose and the experiments they conduct are highly similar both in formal structure and in content to the research in Geneva. Some of the more striking differences concern the way in which experience is viewed in that the Harvard group entertains the proposition that a child of any age can be taught any concept, given appropriate training conditions and opportunity to learn the prerequisites (Bruner, 1961).

The work of the Kendlers and others on the reversal shift task might well be viewed as an intensive investigation of one type of concept which could have been studied by the Piaget group but which has the special function of shedding light on the type of mechanism or process employed by children of different ages in acquiring the same concept. Very young children, and even rats, can and do acquire the reversal shift concept, but that they do this differently from adults is evident from their behavior in a transfer situation. The task involves presenting two objects, a square and a triangle, one black and one white. The task of the child is to select the black one on every trial whether it be the square or the triangle. Some children are given a reversal shift transfer task and others are given a nonreversal shift task. For the reversal-shift transfer task the child is suddenly rewarded for selecting the object having the opposite value of the same dimension he has been responding to. That is, if he has been rewarded for selecting black, he is suddenly rewarded for selecting the white object. For the alternate transfer task, reward is given for selecting the object which exemplifies a value on the other dimension which has theretofore not been relevant, e.g., selecting the square regardless of whether it is black or white. The major difference (between adults and children) which the Kendlers believe to be involved is the presence of a mediator, in a way, a concept, in the case of the older Ss.

Analysis of the reversal shift task indicates that if the child has been responding with the mediator black, the reversal shift does not require that he shift dimensions; the same mediator works, but the opposite is now correct. It is important to notice that despite the fact that in the past, the S was never rewarded for the white object, older children perform a reversal shift of this nature quite readily. However, consider the nonreversal shift from black to square. In this case, he has been rewarded in the past half the time for square (when it happened to be black). Thus, if he has no mediator and is responding on the basis of reinforcement buildup, he should learn to select square more readily than

white which has never been rewarded. This type of explanation has been employed to explain the reasons why kindergarten children can learn a nonreversal shift more readily than a reversal shift (Kendler & Kendler, 1959) whereas college students learn reversal shifts more readily than nonreversal shifts (Kendler & Kendler, 1962). Recent evidence indicates that if the actual objects are changed for the transfer learning, the greater ease of learning nonreversal shifts compared with reversal shifts is increased with four- and ten-year-old children (Jeffrey, 1965). This study suggests that developmental changes in reversal shift behavior may reflect young children's inability to transfer a mediating response or a response to a single dimension when the stimulus context changes. However, no control group maintaining the same response when the stimuli were changed was used.

In general, the literature emerging on shift behavior suggests that the task is more complex than originally believed. For example, overtraining on a discrimination involving a single dimension improved reversal learning in six-year-olds (Tighe and Tighe, 1965). In addition, retarded children showed no superiority of nonreversal shift over reversal shift though one would expect on the basis of the verbal mediation theory that they would. In terms of the two-stage model being proposed, one might say that the reversal shift results might reflect the operation of both processes, the associative and deductive. Learning depends on the tendency for the simple geometric forms to elicit associative responses reflecting an unidimensional characteristic and can reflect the tendency of the S to test hypotheses. Both of these tendencies should increase with age and should promote the learning of both types of shifts although the change in the associative process should produce the mediation effect discussed by the Kendlers.

The third type of concept learning situation which has been studied intensively concerns concepts similar in structure to the reversal shift situation in that the stimuli usually consist of perceptual forms having a specified number of dimensions and varying with respect to given values on those dimensions. This type of task was employed by Bruner, Goodnow, and Austin (1956) and has been adopted by other investigators. In their experiments, the S was typically presented with a board containing all possible instances. If the stimuli varied on three dimensions, e.g., color, shape, and size, each having two values, e.g., red, green; square, triangle; large, small, the eight possible figures would be represented. The S would be shown a positive instance which would be an instance of a concept characterized by 1, 2, or 3 relevant dimensions. For example, an instance character-

ized by two relevant dimensions might be a red triangle which is either large or small. Many variables have been studied with respect to this type of problem situation, and in general, it may be said that the results bear on the hypothesis testing process and how it operates, rather than on the associative process since it is assumed that the S readily observes the alternatives or features from which the hypotheses are to be formed and concentrates on deducing the necessary characteristics of the concepts from this pool. It is almost impossible to discuss the large number of results which have been obtained using this type of task, but a few illustrative examples will be given. Bourne (1965) compared the strategies employed by relatively good and poor problem solvers and found that the poor learners failed to change their hypotheses as readily after it had received disconfirmation and also tended to formulate more complex hypotheses which reflected less of the information at hand than did the faster learners. Performance has been found to get worse as the task is made more difficult either by increasing the number of relevant dimensions or by increasing the number of irrelevant dimensions (Bulgarella and Archer, 1962; Walker and Bourne, 1961). Negative instances or instances which the Ss are told are not exemplars of the concept are more difficult for Ss to use than positive instances (Hovland and Weiss, 1953). However, when Ss are trained on learning from negative instances with many (20) successive problems, they can learn to use them with a facility equal to their use of positive instances (Freibergs and Tulving, 1961).

One of the most important determinants of problem difficulty appears to the extent to which the experimental arrangements require the S to remember the instances which he has observed and their outcomes (e.g., Cahill and Hovland, 1960). Attention in this area has recently been centered on testing fine points derived from the various mathematical models of concept identification which have been produced (Restle, 1962; Hunt, 1962). The study of concept identification indicates clearly that separation of concept formation into tasks which bear clearly on one process while largely avoiding emphasis on the other makes possible a relatively clear assessment of the underlying behavioral processes.

Studies which bear largely on the associative processes have their roots in the study by Underwood and Richardson (1956) in which Ss were given word pairs to be learned for which the response member of the pair was a sense impression with which others had characterized the word. For instance, they learned pairs such as diamond-shiny; badge-shiny; linen-white; mirror-shiny; rice-white. The list consisted of 24 pairs of which 4 were instances of each of 6 concepts.

Before running the experiment, the investigators had collected sense impression responses to 213 nouns and determined the percentage frequency with which each response was given to each word. Then, when constructing their paired-associate lists, they gave each S two easy, two medium, and two hard concepts. In other words, if a high proportion of Ss gave white in response to rice and linen, these pairs, rice-white and linen-white, were classified as high dominance or, in our terminology, as instances of an easy concept. If a low proportion of Ss gave the responses, then such pairs would have been classified as low dominance. As expected, it was easier to learn the pairs exemplifying the high dominance concepts than the low dominance concepts.

Thus the speed of concept attainment depends on the pre-existing tendency of individual instances to elicit the concept which is to be learned. But it also depends on other factors. For example, it depends on the tendency of the instances to elicit concepts other than the one being taught. Underwood (1957) studied the effects of ease of concept attainment of employing instances which crosscut the concepts to be attained. In one of the lists in which these cross-associations were employed, rice was used as an instance of the concept small, but it also suggests both white and hard which were two other concepts in the same list. As expected, the lists in which these cross-associations occurred were harder to learn than a list in which no instance of any concept had any strong common associate with instances of any other concept. In addition to these experiments, there is quite a large body of literature which tends to support the notion that concept difficulty depends on the associative characteristics of the instances and the interrelation of associative characteristics among the various instances presented. In many of these experiments, concept formation in a basic sense is not being studied since the S is given the concept name as a response to the stimulus word and all he has to learn is to remember which of the alternatives goes with the presented stimulus instance. Thus, the S is not forming the concept hard within the situation but is learning to apply it to the set of instances being presented.

Although I am maintaining that this type of learning is mainly associative, it is conceivable that S could use hypothesis testing when the stimulus is presented and he is to try to anticipate the response. In this case, he is likely to know the alternative responses (concepts) within the list, e.g., hard, small, and white, and may guess one of them. However, the need to use a deductive strategy is quite limited because he is immediately informed not only as to whether he is right or wrong but also what the correct concept is.

Therefore, he has no need to deduce anything in order to learn. But if he uses this guessing procedure which is a primitive form of hypothesis testing, it is likely that his incorrect guesses will tend to be learned and in this way retard the learning of the correct conceptual responses. In short, concept learning of this type is mainly associative in nature; and although strategies may be employed, there is little opportunity for them to facilitate concept learning.

The second part of this paper deals with the writer's work on the processes of concept formation, mainly involving experimentation on the effect of variety on concept formation and associative processes. The first series of studies concerns the acquisition of concepts of a different type from those already discussed. It concerns the acquisition of semantic meaning of words from the sentences in which they are used. By variety, referral is to the number of different instances presented to the child from which he is to form a concept. Implied is the notion that the greater the number, the greater the diversity of the set of instances.

Now to return to the problem of acquiring word meaning from sentences in which they are employed. Word meaning may also be acquired in other ways, for example, by repeated pairing of concrete instances of the concept with its name or verbal definition. Logically, the process of the acquisition of meaning entails both the formation of a new concept and the attachment of a name to it. The former process is perhaps the dominant one for young children while the latter is of major importance for second-language learning.

The particular situation which is the main concern of the present paper is the manner by which the meanings of unfamiliar words are acquired from verbal contexts, such as those shown in Table 1. These materials are a modification of the Word Context Test, an ingenious instrument devised by Werner and Kaplan (1951). The most prominent process by which the meanings are elicited is an associative one. The meaning of the new word in its original sentence context would include the associative responses to the preceding part of the sentence, associative responses to the sentence as a whole and responses to particular words in the sentence. The preceding part of the sentence will be emphasized particularly since it is likely to have an important role in the elicitation of associations which may become part of the meaning of the new word. A theory of how this would come about can be derived from a model suggested by Ervin (1961). This model presumes that as sentences are presented, the hearer anticipates the succeeding words. In the present situation, it would be expected that the sentence context

preceding the new word would elicit an anticipatory response which would occur contiguously with the new word and would tend strongly to be of the correct part of speech. The meaning of the new word would consist of this anticipatory response but could also consist of other associations to the particular sentence. A subsequent sentence should again tend to elicit an anticipatory response which would occur contiguously with the same new word. The new word would in turn elicit the associations which had occurred with it in the first sentence Thus, the associations to the first and second sentence contexts would tend to occur together. In general, as sentential contexts are added, associations should become strengthened and nonrepeated associations should drop out. The associations which are strongest would then be those for which there is some multiple determination.

Table 1

Materials used in Experiments on the Acquisition of Word Meaning

Sample Problem

1. Our teacher is very much like an indar.
2. The puppies cried out when their indar left them.
3. Aunt Sarah is going to be an indar next summer.
4. A big sister is like an indar.
5. An indar helps you when you are in trouble.
6. Indar said you must wear your coat.

Finish, complete

1. You should try to pilster the things you have left half done.
2. Mary cannot pilster the problem because she doesn't understand it.
3. If his homework is hard, John doesn't pilster it.
4. Phillip asked Joan to help him pilster his homework.
5. You must have patience to pilster a job.
6. The painter could not pilster the room because his brush broke.

Light

1. It is decket longer in summer than in winter.
2. Large windows make a house decket.
3. Mother likes John to be home when it's still decket.

4. The front yard was dark, but the porch was decket.
5. It should be decket for reading.
6. The TV is decket.

Soft

1. When it got warm, the candle became bocker.
2. If you don't want it to be heard, your whisper should be bocker.
3. Uncle Ed likes a bocker chair after dinner.
4. Baby clothes are usually made in bocker colors.
5. A fur coat is bocker and warm.
6. Many people leave a bocker light in the bathroom all night.

Dream

1. After seeing the ghost movie, Sue hated to go to bed for fear of what she would lagger.
2. When Billy used to lagger he didn't know whether it was real or not.
3. When dogs move strangely in their sleep, we wonder if they can lagger.
4. Jimmy wants a new bicycle so badly that he will probably lagger of one.
5. When George doesn't know the right answer, he may sometimes lagger one up.
6. Many people can't remember what happens when they lagger.

Obstacle

1. Jane had to turn back because there was a corplum in the path.
2. The way is clear if there is no corplum present.
3. A lazy man stops working as soon as there is a corplum.
4. A corplum keeps you from doing what you want to do.
5. Some people don't want to start a job if they know there is a corplum.
6. He had to get rid of the corplum before finishing the task.

Stick or piece of wood

1. A long surta may be made shorter.
2. A wet surta does not burn.
3. You can make a surta smooth.
4. The painter used a surta to mix his paints.
5. Many things may be made out of a surta.
6. You can use a surta for many things.

Happiness

1. Some people think about the things that bring them tortum.
2. After trouble tortum usually returns.
3. The woman remembered the tortum she had as a girl.
4. The people at the circus usually seem full of tortum.
5. Comfort at home and a good job were all that Uncle Ben needed for tortum.
6. Tortum and good health are found together.

Stones

1. Billy collected different kinds of garids.
2. Some garids are found under water.
3. Garids often make a road very rough.
4. Only bad boys throw garids.
5. A farmer does not like to find garids in his fields.
6. Garids can be polished to look smooth and shiny.

Courage

1. If you have narish you will not cry when you get hurt.
2. You need narish to fight with a boy bigger than you.
3. If you do something bad and then tell the truth, you have narish.
4. We all admire someone who has much narish.
5. A person who saves a baby from drowning in deep water has much narish.
6. You need narish when you start to do a hard job.

Faults, defects

1. If a suit has many elsons it is sold very cheaply.
2. A person who has many elsons usually has few friends.
3. People with elsons are often unhappy.
4. Some elsons can be fixed.
5. Some things are useful even if they have many elsons.
6. People usually talk about the elsons of others, but not about their own.

The major hypothesis of the experiments to be described was that if a word occurs in relatively few sentence contexts, it should be more difficult to acquire its meaning than if it has occurred in many different sentence contexts. Before amplifying this hypothesis, it may be helpful to consider the specific tasks employed. They entail the acquisition of the meanings of words from different numbers

of sentences.

The version of the task employed in two experiments consisted of the sets of six sentences, each containing the same artificial word as shown in Table 1. One of the experimental conditions, large variety, involved presenting all different sentences within each set and then requiring that the S define the new word. The other experimental condition, small variety, entailed presenting only some, e.g., three of the sentences, each repeated once. Thus each S was exposed to six sentences before defining the new word, but the conditions varied with respect to whether the six sentences were all different or were repetitions of the same sentences. The hypothesis was that the large variety should facilitate the production of the correct concept.

For the small variety the same sentences would be repeated, and this condition should tend to strengthen many incorrect associations since the same incorrect associations would tend to occur in response to the repeated presentation of the same sentence. For the large variety, on the other hand, no sentences would be repeated. Different sentences would tend to have fewer incorrect associations in common than repetitions of the same sentence. Thus, for the large variety there should be little strengthening of particular incorrect associations. As a consequence, the correct association would have less effective competition from incorrect associations in the large variety condition.

There is also a possibility that the task is actually a two-stage process involving not only association but also deduction. Specifically, Ss who have learned deductive strategies, and who are appropriately motivated, may check the accuracy with which their associations fit preceding and subsequent sentences. The probability of recalling or observing a different instance is greater for a large variety than for a small variety. Based strictly on the logical probability of rejecting false hypothesis, deduction should also be aided by a large variety since the ability to reject any particular incorrect hypothesis would be assisted by the presentation or recall of a sentence which is different from the one which initially elicited that response.

All experiments employed a repeated-measure design in which half of the concepts were learned by a large variety and half were learned on the basis of a small variety. Experiment 1 involved the acquisition of two nouns, newspaper and train, as a function of variety and instruction given to the S. The sentences were woven into stories which were approximately the same length but which varied in redundancy,

the small variety stories being highly redundant. This experiment was conducted with children of two age levels, six-year-olds in kindergarten and ten-year-olds in fourth grade. Half the Ss were instructed to listen to the story and not pay any particular attention to strange words. Experiment 2 entailed single sentences similar to those which appear in Table 1, and the concepts were the verbs gather and increase. Experiments 3 and 4 employed the materials which appear in Table 1. For experiment 3, the small variety consisted of two different instances, each repeated three times; and for experiment 4, it consisted of three different instances, each repeated twice. The large variety was six sentences in both cases. Subjects were ten-year-olds and were instructed to try to learn the meaning of the new words. In each experiment there were two assignments of nonsense names to concepts. The experimental procedure involved reading all of the materials for each concept and then recording the Ss best guess as to the meaning of the word.

Consider now the responses after all the materials were presented; i.e., for experiments 2, 3, and 4 it was the response after the presentation of the sixth sentence in each set. The results showed, as hypothesized, that children in both age groups tended to form more correct concepts on the basis of the large variety than the small variety. However, the result did not reach statistical significance in all studies. As an aside, it is mentioned that there were also two reverse trends: one among older children of experiment 2 who were forming concepts under incidental learning in which children were not instructed to learn and one among the older children of experiment 1 who were relatively slow learners. In both cases, the reverse result can be attributed to the better recall of particular instances in the small variety condition. When at the time of test a particular instance is recalled, some guesses can be entertained concerning the meaning of the new word, even if none occurred during the learning period; but if no instance can be recalled, it might be impossible to produce a correct association.

In general, however, there is a reliable advantage of the large over the small variety among the older children when they were instructed to learn the meaning of the new word. As a check on these results, the data from experiment 3 were reprocessed in this way. The number of correct responses after the first three sentences was compared with number of responses which were correct for the first time after the second set of three sentences. Although the data do not lend themselves to standard statistical tests, there is no

appreciable difference between the large and small variety conditions on the first set of three sentences, but there is considerable difference on the second set of three. (For large variety, there were 84 correct responses vs. 23 on the second trial while, for small variety, there were 91 correct responses on the first trial and 7 correct on the second trial.)

There are almost no idiosyncratic responses given to groups of sentences, neither groups of three nor groups of six. However, for single sentences, on the average, 17 percent of the Ss give an idiosyncratic response to each single sentence. Consequently, the number of incorrect associations is potentially enormous, but the procedure of grouping effectively reduces the number of these very weak competing associations to zero. A further examination of the data shows that more generally, grouping reduces the number of different incorrect associations. The mean number of different incorrect associations given by all Ss to a single sentence representing a single concept is 9.5 while the mean number of different incorrect associations given in response to the grouped sentences was 4.0. There was no difference between the groups of three and the groups of six in this respect, that is, in the number of different incorrect associations produced. However, there was a difference between the groups of three and the groups of six sentences with respect to the strength of each of the wrong alternatives. The mean strength of incorrect alternatives was greater for groups of three than for groups of six and the weakest of all for the singles. Thus, for single sentences there are more incorrect alternatives than for grouped sentences, and their average strength is weaker than the strength of the incorrect alternatives for grouped sentences. The groups of three and six sentences varied only with respect to the strength of the incorrect alternatives and not with respect to the number of incorrect alternatives. The strength of the incorrect alternatives is greater for the sets of three than the sets of six. The difference between the single sentence and the grouped sentences with respect to number of incorrect alternatives was found to be almost entirely due to the disappearance of the idiosyncratic response which was brought about by grouping.

In general the evidence is consistent with the point of view that meaning is acquired by associations to the immediately preceding and prior contexts. It further suggests that acquiring the meaning of verbal concepts involves a build-up in the strength of associations which are common to the new word in a multiplicity of contexts, rather than a reduction in the total number of associations which are

elicited. The striking reduction in the total number of associations which are elicited comes about, presumably, the very first time the new word appears in a different context since it was found that there was a striking difference in the number of different associations given to the new word in one context compared with the new word in three sentence contexts.

Although the data clearly showed the large variety to be superior to the small variety and the explanation seemed to fit the facts, there is another chapter to the story. In doing research on large and small variety using very different tasks, support for the opposite result was found in each case: a superiority of the small variety over the large. The discrepancy bothered the writer until realization of what the difference in the tasks was occurred. In the other tasks, the difficulty of the various sentences could easily be assumed to be the same, while the difficulty of the various sentences in the research described surely could not. Therefore, the sentences were given as single units with blanks instead of nonsense words to ten-year-old children. The sentences were not grouped according to the concept they had been used to exemplify, and only two sentences from each concept were given to each S. Ss were instructed to fill in the blanks with the word that fit best, and from this, the percentage of children who gave the "correct" concept was determined. Each S from the concept learning experiment 3 was then given a score corresponding to the difference between the mean percentage of correct concepts he elicited and the mean percentage which would be expected on the basis of a chance estimate. This chance estimate was the proportion he would have attained if he had only received the best single instance in every set. By this measure, no difference between the large and small variety was observed because there was an overall difference in the occurrence of the best single instance in the entire set of six. This instance always occurred in the large variety, but it only occurred in some of the smaller sets. When only those small varieties which contained the best single instance were compared with the large variety which necessarily also contained that instance, performance in the small variety conditions was found to be superior to performance in the large variety conditions.

Another series of experiments using a drastically different type of concept and a drastically different procedure were the set union and set intersection problems. In this case, the small variety produced a trend toward easier learning than the large variety and a clear superiority by the small variety for transfer to new instances. In another

type of situation, Gagne and Bassler (1963) found no difference as a function of variety. However, without going into further detail of these experiments or others, it can be asserted that in general the results support the finding from the verbal acquisition experiments: That where the best single instance is equal in the case of large and small sets of instances, the smaller set facilitates to a greater degree than the larger.

To sum up the role of variety in the two processes of concept attainment, it appears that a small variety is usually found to be better than the large variety because of four theoretical reasons while there are only two reasons why a large variety should facilitate. The reasons why the small variety should facilitate are 1) that they elicit fewer associations which might interfere with the correct one or fewer false hypotheses to-be-tested; 2) they permit fewer false rejections of correct hypotheses because of the lower probability of providing very poor instances; 3) that they promote better memory for specific instances, hypothese, and the outcome of their test; and 4) that they provide for a better chance of a prominent placement of the best single instance. The reasons that the large variety should produce superior concept formation are 1) that it enables speedier rejection of false hypotheses and, therefore, testing of more hypotheses per block of trials and 2) that, if the instances are unequal, it provides a higher probability of containing extremely good instances.

From the point of view of teaching, the above conclusions suggest that if the instances are clearly unequal in difficulty and unknown with respect to which are good and which are poor, it is best to provide children with a large number of different instances from which to form concepts; but if the instances can be assumed equal in difficulty, a relatively small variety should be as good or better than a large variety. Moreover, if the difficulty of the instances is known, a small variety of good instances should be clearly superior to many instances even if the larger set contains the best available ones.

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READING, THINKING, AND CONCEPT ATTAINMENT

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THE DYNAMICS OF TEACHING reading as a thinking process requires a teacher who believes that children can think and can be taught to read as scientific readers. The teacher's attitude and skill make the difference between a class in which there are freedom and spontaneity of thinking and discussion and one in which they are shut off. Freedom resides in the vigorous function of intelligent observation of suggestions and opportunities and in the making of judgments so that sound purposes may be developed. Spontaneity suggests the unstudied naturalness of young minds and an agreeable freshness. As Horn pointed out: "In reading, as well as in objective experiences, selection, organization, and interpretation are all governed by purpose. It is purpose that guides the construction of ideas and holds them together" (9, pp. 388-389). Pupils must be required time and again to exercise to the full their intellectual powers so that, as Bruner says, "they may discover the pleasure of full and effective functioning. Good teachers know the power of this lure" (4, p.50). Students should realize what it means to use their own experiences, their knowledge, and their creative powers so as to become absorbed in seeking solutions. The effect of this approach is such that the child generates his own discoveries.

In the thirties on the social-moral-political front one had nothing to fear except fear itself. Today the biggest fear encompassing all is the fear of decision-making. In the thirties reading was still being taught as it has been for decades--on an oral reading, recital level. "Speak the words so that I can hear you read" was the test to pass. "Recite the facts, word by word, and prove that you have read" was the measure of comprehension. Pupils learned "this" kind of reading at home and daily passed in "oral review" before the teacher. It was a review regimented and circumscribed by the open-book, open-eared teacher. The use of the mind to search, to discover, to hypothesize, to prove was shackled to the power of elocution. Sound, not sense, ruled the birchrod and acquitted the scholar. "Don't think; recite" was the motto.

This attitude prevailed in spite of the hard core of

brilliance, perception, and wisdom of such as Bacon, Rosseau, Herbart, Mann, and Dewey. They struck with whiplash authority, demanding brain-stretching creativity of thought--realizing that it was more productive than memorizing names and dates. With eloquence and resolution they have pushed down the Pandoric lid in an attempt to confine the ignorance and anxieties of dogmatic instruction. At the same time they gradually forced open the lid on a new tool box, releasing the method of learning by discovery, by searching and weighing, and by decision-making. Just as surely as there can be only one straight line between two points, there can be only one straight line between thinking and learning.

The older ways of memorizing and reciting are collapsing. The security of a parroted text and a teacher's daily log of recitations is going. The uncharted seas of discovery demand a different kind of confidence, a different kind of cognition, a more comprehensive grasp of freedom and responsibility. Change is the order of the day; every day: yesterday, Lindbergh; today, the John Glenns; tomorrow, who knows? Today, the '68 car; tomorrow, the '69, and the '70, and the '71. Yesterday, the trail and the crossroads; today, the freeway and the interchange. Changes and decisions. This is the challenge that confronts man. One must face up to these conditions not only to keep pace with the world today but more essentially to educate the youth of this land who are brought up on the doctrine of change and discovery. Theirs is a ready acceptance.

The milieu of a directed reading-thinking session provides the foundation. Here, all other things can be held constant while effort is concentrated on using, to the full, pupils' experience and knowledge, wisdom and ingenuity, resolution and faith.

Increasing Powers of Reflection

It is generally conceded that systematic instruction in abstracting, judging, and reasoning can be done at an earlier age than was once thought possible. In fact, Bruner says (4, p.46): "One wonders in the light of all this whether it might not be interesting to devote the first two years of school to a series of exercises in manipulating, classifying, and ordering objects in ways that highlight basic operations of logical addition, multiplication, inclusion, serial ordering, and the like." Then he goes on to say that a comparable approach should be taken to the teaching of social studies and literature (4, p. 46):

"Can one teach the structure of literary forms by presenting the child with the first part of a story and then having him complete it in the form of a comedy, a tragedy, or a farce--without ever using such words?"

Hullfish and Smith (10) designate thinking as the critical educational issue and describe reflection as controlled thinking. They use the term thinking to name the activity of creating, using, and testing meaning and indicate that in a more limited way this term might be referred to as problem-solving. They also declare three interrelated aspects of what constitutes thinking: sentiency, memory, and imagination; and then they describe a fireplace scene to distinguish the three. A man seated by a crackling fire, when asked what he is doing, says: "just thinking." By this remark he may have meant two things: he was largely recalling the past or he was both recalling the past and thinking about what might have been. The former is primarily memory; and the latter, imagination. The raw data of experience--the light and heat and sound--bestir the mental activity known as sentiency. Knowledge, then, is always mediated (an interplay between sentiency, memory, and imagination) and never immediate or just sentiency.

When conscious control of knowledge is exercised, there is an intermingling of emotional involvement and reflective activity. Now something more occurs than to "just think." More than reverie is involved. Effort is now directed or controlled by a purpose. As Hullfish and Smith say (10, p. 36): "Thinking is good or bad, better or worse, only in relation to its directing purpose." The key to all this resides in the controlled use of sentiency, memory, and imagination.

To increase powers of reflextion by reorganizing old ideas, conceiving new ideas, distinguishing between ideas, generalizing about ideas, formulating propositions, and reasoning require controlled thinking. The growth of the mind stems from its power to start and direct significant inquiry and reflection. To accomplish this end, pupils must be required to look ahead and foresee and to do so in such a way that their curiosity and responsiveness result in orderly activity and are based on earlier experience and knowledge. As Dewey indicates, a reflective and truly logical activity is native to the mind and manifests itself at an early period. He says (5, p. 83): "There is an innate disposition to draw inferences, and an inherent desire to experiment and test. The mind at every stage of growth has its own logic." Unquestionably, it is the attitude and actions of the teacher--her mental habits, her personal

traits, her inspiration--that will translate these processes of reflective thinking into appropriate attitudes and mental habits for the children. This atmosphere will cause them to think with the arteries of the mind as well as the skin mind, to use Ellen Glasgow's terminology (7).

If, as Dewey says, all reflective thinking is the process of detecting relationships, then--when materials have been read--the time is at hand to reexamine those elements that warrant further study. Plots can be reexamined to see how evidence piled up, to note where a turning point occurred, to learn how a climax was reached, and to sense and appreciate human and social factors. Nonfiction can be reexamined to see how facts piled up, to note what catalytic agents triggered an action, to see how a conclusion was reached or an hypothesis was validated, to understand and use a scientific or mathematical concept, or to grasp a social-cultural principle determined by concensus. At the primary level in particular, as the attitude of effective thinking is being fostered, it is the human elements that provide the bond. They are the common elements that connect the readers to one another, to the group, and to the characters in the artfully contrived plots. Elements connected with a plot development are of such a kind as to have occurred and reoccurred in many of the experiences of the young student. They furnish the materials that are well suited for the development of generalized thinking abilities.

Developing Adeptness in Semantic Analysis

Semantics is the study of symbols (signs, pictures, words) and their referents (meaning). Another way to define it is to quote the title of Ogden's and Richard's book: The Meaning of Meaning (20). Since to read is to comprehend or to get meaning, the reader should be taught to see the likenesses and differences among meanings.

The primary purpose of language is to communicate. To communicate, Lorge (14:327) says, is to "transmit stimuli to another to modify the receiver's behavior." This means, of course, that the words used to communicate need to have conventional meanings--meanings established or sanctioned by general concurrence or usage. Morris put it this way (18:13): "...the meaning of a term is completely specified when it is known what objects the term designates, what expectations it produces in the persons for whom it has meaning, and what its connections are with other terms in the language of which it is a part." Language, then, is social in origin and function.

The teacher of reading is interested in the semantic

aspects of communication because the use and function of words aid one in thinking more clearly and in making sense when he communicates. While some work is being done on the role of nonverbal learning, it is generally agreed that language is indispensable to human thinking. Words are the symbols used most frequently in reading texts. Graphic aids (pictures, maps, charts, graphs) are used also to communicate but are not used as frequently or for the same purpose as words.

The story of Victor, the wild boy--a lad of eleven or twelve--found living in the Caune Woods in France is related in detail by Brown (3, pp. 3-8) and is relevant here. This little savage Aveyron lived and acted like a beast and was ignorant of any language. Dr. Jean-Marc-Gaspard Itard believed that the boy could be taught to read and speak the French language even though the psychiatrist, Pinel, labeled the boy a congenital idiot.

Working patiently and carefully, Itard did teach him to speak some words by an auditory approach but discovered that he might be more successful on a visual-auditory level. After a time Victor could "read" quite a few words, but he did not understand them. So Itard set out to teach him about the meanings of words. Again, as a result of infinite patience and much repetition, the boy learned the meanings of a few object words, like pen, key, box, and book. Itard always used the same book, pen, box, and key until one day he put aside the objects that had been used and substituted other books, pens, boxes, and keys. Victor failed to make the category association. For him, the word book stood for that one book.

Now Itard began to teach Victor that book stood for a category: books. At first the boy confused paper, pamphlets, and magazines; but gradually he learned to distinguish books. Then began the task of teaching him the understanding of words that name qualities and relations. By means of big and little books, he acquired understanding for size and was able to transfer this knowledge to big and little nails. Itard proceeded similarly with action verbs. So, little by little, Victor learned to read quite a large number of words.

What Itard did was to show Victor that words had referents. What Victor needed to learn was that words name classes or categories and that not all referents are objects but that some label qualities and relations. Brown goes on to say that (3, p. 8): "Any sort of recurrence in the nonlinguistic world can become the referent of a name and all such recurrences will be categories because recurrences are never identical in every detail." Brown defines category as a

class or a grouping of objects or events. To this definition he adds the word attribute meaning (3, p. 10): "any dimension on which objects and events can differ."

It is true, of course, that the children who come to school are not Victors. Yet the problems that Itard and Victor faced--learning to recognize words and their meanings--were like those faced by teachers and children. At the same time it might be said that most children are deprived semantically as was Victor in not knowing a language. Therefore, one must proceed in the same wise and patient manner as did Dr. Itard and teach the skills that will lead children out of the semantic jungle.

Levels of Abstraction. Levels of abstraction might be best defined as a means of grouping or categorizing concepts by an ever more definitive recognition of attributes. Symbols acquire meaning by constant association with their references and their essential attributes. The essential attributes are those which experience has shown to be usually present. Some symbols refer to referent attributes that are readily identifiable: ball--size, shape, weight. Others refer to attributes that seem to have a capricious variety of associations: smile--bright, fleeting, shy.

Like Victor, many children find it confusing when they need to recognize attributes that are relative and of different value. At first Victor associated the word book with one book and probably did so by some of its distinctive attributes of size, shape, color. When he needed to associate attributes with other similar items, he apparently did so at first on the basis of pages since he selected papers in one instance and magazines in others.

Children in the Delaware Valley area, when asked to draw a leaf, frequently produce a leaf that has the attributes of a maple leaf. When asked to draw a maple leaf as it appears early in May, in August, and in mid-October, they are puzzled. When asked to illustrate other leaves common to the area, they are puzzled even more. Like Victor and Dr. Itard, it takes a good deal of careful examining of leaf attributes before children are able to distinguish different kinds of maple leaves--silver, sugar, swamp, Norway--and to separate them from oaks, tulips, locust, sycamore, and so on. From this level to palmate and pinnate is another step. And from this step to the three general classes of leaves--the palm leaf, broadleaf, and conifer--is an even greater task of recognizing potential attributes and categorizing.

It is this kind of identifying of levels of abstraction

that is needed to develop agility in handling categories and attributes. As Brown indicates (3), distinction can also be made between potential criteriality and actual criteriality. He illustrates this point by showing that, even though Victor distinguished books from magazines, he probably did not do so on the bases that books are either one-time publications or republications, whereas magazines are periodicals. Neither did Victor use the publication date of books. These are potential attributes; they are defining attributes that can be used. Actual criteriality describes an attribute used by some person in categorizing, for instance, the attributes that Victor used to categorize books.

Identifying attributes and categorizing can be done even at the first grade level. The word house has many possibilities--frame, brick, stone, ice; one-level, split-level, two-level; single, semi-detached, row; and then going from shelter, to house, to building, to structure. Certainly not all of these attributes and categories will be dealt with in a directed reading-thinking activity, but the process can be profitably initiated.

In an article "Arranging an Orchestra" (25, pp. 177-179) levels of categories are readily determinable and attributes, definable: orchestra, instruments, woodwinds, clarinets. To this group could be added B-flat clarinet, and so on. In the article "Americans Move with their Bridges" (23, pp. 47-53) similar abstracting can be done. Bridges may be classified according to type of supporting elements as slab, beam, girder, truss, arch, cantilever, suspension; according to use as foot, highway, railway; according to position of roadway as deck, through, bottom-road; and, if movable, as bascule, vertical-life, swing, traversing, transporter. Then, too, bridges can be categorized as in architecture--a bridging joist; astronomy-- a band across a sunspot; billiards and pool--the hand used as a bridge for the cue; card playing--a game; dentistry--anchoring artificial teeth to natural teeth; and so on.

Prior to coming to school, children have been busy accumulating a vast number of casual experiences on which is based their stockpile of concepts. As a consequence, many of the concepts formed, their categories and attributes, are vague and haphazard. When pupils are learning to read, they are learning a new set of symbols (printed words) to stand for another set of symbols (spoken words) which stand for their mental constructs (9, p. 398). To do so requires a form of mental discipline not needed when the pupils acquired the first set of symbols (spoken words). This, then,

is the time to put stress on the need for mental constructs that are clear, accurate, and well organized.

Shifts of Meaning. In a story "Two in One" the word stand is used as a noun to mean a stall or booth for business. Children reading this story and required to deal with the word stand raise no questions about its use. The story context and the picture context help get across the idea that in this instance stand means the place where the lemonade was sold.

When the children first learned to read the printed symbol stand, the word was being used to signify a verb--an intransitive action verb--meaning to support oneself on the feet in an erect position. This is probably the most common meaning for stand and is in opposite position relative to sit. These two words were introduced among the first fifteen in a series. Sit was introduced in a context where Dad was arranging the family in order to take an indoor picture, and he wanted Mother and Susan to sit on two carefully placed chairs. In the next sequence Dad was asking Bill and Nancy to stand behind Mother and Susan.

The mental construct of sit and stand is so well established in the minds of children that they readily learn to recognize and recall the printed words. This kind of symbol-concept control is helpful in the learning to read stage. When the shift of meaning occurs from stand (to get on one's feet) to stand (a stall or booth), many children readily make the transfer. They do this without realizing that in one instance stand is used as a verb and in the other, as a noun. Even so, this is the point at which attention can be given to raising the verbalism curtain--the use of vague and inaccurate concepts. This is the time to check on the quality of the constructs.

Pupils asked to define stand as used to designate Jack's stand and Cooky's stand have a fair idea as to the meaning: "It's where Jack sold his lemonade," or "It's where Cooky sold his lemonade." When asked to describe a stand, they say: "a box on which you can put things to sell," or "a box with a sign on it." Then when asked to name some other stands, on occasion someone comes up with the "ice cream stand" idea and can describe it.

Most children at this point resemble Victor in that they are vague about the definitive and potential attributes that will help them put stand in a category. Victor needed to struggle with the shift from book (one book) to book (many books). At this point the children could very easily "get

by" with their concept of stand, if the teacher is one to let them do so. If the teacher is not about to let them get by, but one who is ready to begin the lifting of the verbalism curtain, the children will begin to realize that building mental constructs is an active process.

So, in the hands of an able teacher, these children will now have three instances for stand and three descriptions: Bill's stand, Cooky's stand, an ice cream stand. Some will be ready to jump the category gap and attain a generalized meaning for stand. Others may need more experience with stand on the descriptive level: a newsstand, an umbrella stand, a taxi stand, and so on.

At a later level the same vigorous attention must be given to the word stand. Then children will learn what it means to "stand up and be counted," to "take the stand," to "stand firm," to "stand accused," to "stand for reelection," to "stand the cold," to "stand in judgment," or to "stand a chance."

As has been shown, a single word can "stand for" many things. The unabridged dictionary lists forty-eight different meanings for stand. Is stand an "easy" word? Is it a "hard" word? Easy and hard are but names and, when linked with a word on the potential criteriality level, can be deceptive. Stand is a common word in that it appears frequently in writings and is used often in speech. Some of its concepts are very common and have been "constructed" by almost all, regardless of language facility and intelligence. But for students to attain all of its concepts requires experience, interest, intelligence, vigor, persistence, and efficient work habits.

At a higher level, a word like coral may for many pupils be merely the form of a symbol and not really symbolize. Not only is it necessary, then, to construct a concept but also to alert the pupils to its shift in meanings. This word is introduced in a story about spear fishing in the Red Sea. It occurs in the context (23, pp. 14-15):

> Swimming below the surface, Omar admired
> the many strange fish that swam about.
> Unusual and beautiful plants brightened
> the coral.

Again, in the next paragraph:

> If he swam too near them on the coral,
> the clams could close quick as lightning
> over his hand.

On the next page:

> Then the shark suddenly disappeared into

one of the deep shadowy places among
the coral.

The trained reader, if he does not know the meaning of coral, will, when he first meets the word, check for meaning in the glossary. At this point in a directed reading-thinking activity, the reader is still on his own and is putting to work the skills which he has been taught and which he is refining and developing into sound reading habits. The teacher is present to see how efficiently he does operate in this "controlled" context. She notes whether pupils are using the glossary while reading. This may be a skill that needs reteaching.

Turning to the glossary, the pupil finds the following (23, p. 276):

> coral (kor´ al), 14. 1. A hard material like stone, with different and often bright colors, built up of countless skeletons of certain animals which grow in shallow tropical seas, and often appearing at or above the surface as reefs or islands. 2. One of the tiny animals that produce coral. 3. The color of orange red.

The explanation given, along with the glossary illustrations, usually is sufficient to permit the reader to go on with the story.

When the story has been read and other skill-building activities are being directed, the alert teacher makes a double check on such words as coral. Did the pupils grasp sufficient meaning, at this stage of their maturity, to go on? Did they grasp the three meanings given? Certainly at this point they are not ready to deal with the definition such as found in an unabridged dictionary: "1. a. the calcerous or hornlike skeleton of various anthozoans and a few hydrozoans (the millepores); also, the entire animal which produces this skeleton.

At this point a teacher may produce some coral, perhaps available from a library or science department, so that the language appropriate to the concept coral and the understanding of coral may develop together.

All of this work with coral, and particularly the approach to the word--i.e., pupils meeting the word first in the story context--are recommended because it is understood that a pupil cannot be given meanings but that he can be motivated and directed in building his own mental constructs.

Children are certainly not complete neophytes at dealing with shifts of meaning. They love fun and especially a play on words. They respond heartily to such items as

Fed: "Say, do you know what the wallpaper said to the wall?"
Ted: "No, what?"
Fed: "Stick 'em up. I've got you covered."

Betty: "When is a piece of wood like a king?"
Bruce: "When it is made into a ruler."

Referential and Emotive Language. A strong northeaster whipped across the ocean at gale force. All day long it churned the sea and heaved and tossed the water into huge and tumbling waves. Beating and pounding, the waves smashed upon the shore while roaring as if to drown out the blatant wind.

Every statement made about this gale symbolizes some aspect of it thought to be important to the writer. Each is measured by the interest, experience, and purpose of the writer. Each is interpreted according to the interest, experience, and purpose of the reader.

This account of the gale may be sufficient to help the writer make an adequate recall of the experience at some future time. Whether it will arouse in the reader the recognition of a similar experience is difficult to say. Much depends upon the reader's experience and maturity. All the writer can do is use words that satisfy his purpose syntactically, pragmatically, and semantically (9, pp. 387-389). All the reader can do is reconstruct the ideas for himself within the limits of his experience and ability.

Language symbols, in order to fulfill their fundamental requirements semantically, should arouse about the same expectations in those who use them. Syntactically, language is a system of interconnected signs which the writer and the reader should understand. Both should appreciate the nature and the significance of this interconnectedness. Pragmatically, it is purpose that is fundamental. This dimension includes the relation of language symbols to the purpose of the writer and the reader. Add to this Altick's statement about reading in the Foreword to Preface to Critical Reading (1, p.xv):

> True reading involves comprehension of material--comprehension far more penetrating and detailed than that required for a brief report on subject matter. True reading means digging down beneath the surface, attempting

> to find out not only the whole truth about what is being said, but also (and this is, in the long run, more important) the hidden implications and motives of the writer. When a reader finds out not only what is being said, but also why it is said, he is on the way to being a critical reader as well as a comprehending one.

To this Altick adds that college freshmen have been found lacking in these two vital respects--comprehension and criticism. This inadequacy is understandable in this round robin comprehension era. Twelve years of reading and parroting has taught them to "get nothing out of it."

Referential language is the language of literal truth, or the language of fact. What is the literal truth about the wind described in the first paragraph in this section (p.15)? What are the facts? A wind is blowing; it is out of the northeast. Its velocity was such that it could be labeled gale force; it blew all day; waves breaking on the shore made much noise, at times louder than the wind. A gale force wind can range between twenty-five and seventy-five miles per hour; beyond that it's a hurricane. In this case, what was the force--twenty-five, fifty, or seventy-five miles per hour? There is considerable difference. How high were the huge waves? How loud in decibels was the roar of the surf? How loud was the wind? In short, there were not many literal facts in those three sentences.

Emotive language tries to evoke a mood, a state of feeling, an attitude. The opening paragraph does just that--evokes a mood. A strong northeaster, not powerful, or mighty, or intense, or rock-ribbed, or titantic--but, to a degree, all of these. This wind that whipped across, did it switch, knout, swinge, rush, surge, thrash? When it churned the sea, did it stir, beat, and agitate as when one churns butter? Yet one "gets the idea," especially if one has had a similar experience.

Even the most literal words can be emotive--nylon, polyester, stratosphere. Nylon, to a woman who finds a run in her stocking, has a meaning quite different from what it does to the scientist who discovered nylon. For each it has both literal and emotive meanings. Similarly, polyester has one meaning to a chemist in his laboratory and another meaning for the same chemist closing a sliding door partition in a church educational building. Stratosphere has many meanings to the designer, to the Air Force general, to the pilot, to the pilot's children.

Oliver Wendell Holmes said that when two people are engaged in a conversation, six persons are actually involved. His example was a conversation between John and Thomas where the six personalities to be recognized are the real John, John's ideal John, Thomas' ideal John, the real Thomas, Thomas' ideal Thomas, and John's ideal Thomas (8, p. 53). Similarly, it is said that there are three sides to every question: my side, your side, and the right side. The right side may be hard to find, but seek it one must.

Definite and Indefinite Language. "One night at twelve o'clock, a raccoon came out of the woods. He was wet and dirty. His feet were full of mud. But he didn't care. He was out to visit people" (8, p. 170). This passage seems to be quite definite. But, is it? "One night" does not say which night. Was it the night of December 1, 1963? If so, was it midnight in Michigan or midnight in California? If it was midnight in Michigan, it was only 10:00 p.m. in California but it was 1:00 a.m. in Maine. Was it a grove of trees this raccoon came out from? a dense forest? an evergreen watershed? How wet was he? Had he failed to shake himself? How dirty was he? What does "full of mud" mean? Were the soles of his feet covered or the entire paw? Can raccoons care? Do they have feelings as do people?

The passage about the raccoon was lifted from a story that begins with this line: "This is a story that really happened." This being the case, should not the facts given be really as they happened?

"By 1959, people in the United States owned 40,500,000 record player turntables. There were 3,912 radio broadcasting stations of which 592 stations were FM" (24, p. 118). Certainly this is a passage filled with definite terms. Does "by 1959" mean January 1, July 1, or December 31, 1959? Did the people "own" the record players? Were there exactly 40,500,000 players and not 39,987,623?

Is it not more definite to say "My home is one mile from here" than it is to say "My home is a short distance away"? Surely "one mile" is more specific than "a short distance." Is it not more specific to say "I'll be in New York City all day Monday" than to say "I'll be in New York next week"? Just how far away is a mile? Is it 5,280 feet? Is it a fifteen-minute walk? Will you take 4,370 steps? Is it how tired you will be after walking a mile? Well, it all depends--does it not?--on who is saying what and why, and on who is reading what and why.

How definite or indefinite does a writer want to be as he touches the emotions of the reader and why? Does he want to arouse pleasant or unpleasant feelings, deep-seated fears or anxieties, or sentiments or sympathies or to provoke certain actions--just what is he about?

> I feel so exceedingly lazy,
> I neglect what I oughtn't to should!
> My notion of work is so hazy
> That I couldn't to toil if I would!
>
> I feel so exceedingly silly
> That I say all I shouldn't to ought!
> And my mind is as frail as a lily;
> It would break with the weight of a thought! (15)

The humor of those lines is readily apparent, as is the lazy, carefree, relaxed state that the writer wants to arouse.

> I must go down to the seas again, to the
> lonely sea and the sky,
> And all I ask is a tall ship and a star
> to steer her by, ... (16, p.20).

This author seems quite definite, does he not, about what he wants and about what he wants for the reader.

> "Sure!" spoke up an old Cape Cod whaler.
> "Those whales will make matchwood out of
> their boat. The boys will be sliding down
> some whale's throat before they can swim one
> stroke" (24, p.13).

Conclusion

In his article "Do You Really Understand Brainstorming?" Parnes (21) writes about the kaleidoscopic mind. This analogy of the kaleidoscope is a most fitting way to enlarge on the concept of the organization of ideas or concept attainment.

A kaleidoscrope is a drum-like device fitted at one end with pieces of crystal of different color and design. At the other end is a peephole through which the pieces of glass may be observed as they fit into various patterns. By manipulating the drum, the viewer can see countless patterns. If a new piece of crystal is added to the kaleidoscope, one sees a slightly different pattern. If the drum with the new stone included is manipulated, a large number of new possible patterns can be seen.

The brain operates in a similar way. It stores millions of crystals of knowledge and experience. If one manipulates those crystals by turning on the brain with a stimulus, one can get countless patterns. The word dog can evoke countless numbers of dogs in the mind of a pupil listener. If the pupil is introduced to the concept of pedigree and mongrel, many new combinations and arrangements can be obtained.

The teacher can, by adding new "crystals" to the mind and by manipulating or turning the kaleidoscopic mind's arrangement of the crystals, cause pupils to see countless new combinations. At first the judicial powers of the teacher are required to screen and develop the most likely ideas. However, in due time and with proper direction the young minds should learn to be selective and judicial.

Things and events tend to have a certain amount of coherence of organization. They have a harmony and a logic. It is the wise teacher who helps her pupils sense the harmony and grasp the logic of ideas. She can best give meaning to the definition of education drafted by Mowrer. Education, he says (19, p. 675) "...is a means whereby one person (usually through language) helps another solve some problem more quickly than he himself could do on an unaided (trial and error) basis."

An isolated fact is of little, if any, value. Yet one of the most frequently voiced criticisms of education is that it involves too much parroting of undigested facts. Teachers deny this vehemently. Yet, as Dressel points out (6, p.3) "Someone wisely remarked that we judge others by their words and deeds; ourselves by our thoughts and our intentions." Undoubtedly it is not the intent of teachers to require of their pupils as the measure of achievement a parroting of facts either by recitation or in written examinations. Furthermore, teachers would readily agree with the committee for the yearbook, The Integration of Educational Experiences (6), that the integration or the organization of ideas is the central problem of education. And they would agree that the task is not that of teaching all patterns of organized knowledge but to develop students who will seek to do this learning for themselves.

This statement does not mean that organized experiences or ideas are not used. Rather, it means that their use must be tempered by the wise use of organizing ideas. If one is told to look at organized labor, one is apt to look at the who and what of organized labor. If, on the other

hand, one is asked to see how labor is organizing, one looks to the process--the why and the when (timing) and the where (location) of things. Similarly, if asked to look at a picture of a gyroplane, one expects to see a plane; but if one is told that the picture shows gyroplaning, one expects to see the process. Organized ideas are ideas that have been organized for one. Organizing ideas suggests that one does it oneself.

In teaching the organization of ideas and the organizing of ideas, it is the thinking of the student that is of chief concern. The teaching must be done in such a way that the student is caused to work at pulling the ideas together. This way, learning effectiveness can be improved. Studies (11, 2) of remembering and forgetting and of learning curves provide much evidence concerning the effect on retention and use of dealing with organized ideas, particularly logical organized ideas. Not only can organized material be better remembered and used but also more can be remembered for a longer period of time. Organized ideas represent the same kind of frugality in dealing with knowledge as the frugality suggested by the economy-size package in the supermarket. Krathwohl (13, pp. 47-48), in reviewing Miller's (17) analysis of the operation of memory in terms of information theory, points out that one can carry more wealth in a purse that is filled with dimes than with pennies. Similarly, memories stocked with rich economy-sized packages of information--information that is organized and scaled according to complexity--can be used to better advantage.

The American Heritage. Thomas Jefferson, a great American innovator, gave direction to this nation far ahead of its time and prophetic for centuries to come. He advocated free elementary schooling for all future citizens, the selection and encouragement of promising secondary school students, and free university education for those qualified. This Jeffersonion tradition is becoming the American tradition and the American heritage at last, in the latter half of the twentieth century. Thomas Jefferson, the author of the Declaration of Independence, put the highest value on education so as to protect individuals in the free exercise of their natural rights, emancipate them from prejudice, divest them of all bias, fix reason firmly in her seat, call to their tribunals every fact and opinion so that both sides of a question can be clearly presented, question with boldness, make inquiry without fear of its consequences, be answerable for the uprightness of their decisions, and make observations founded on examined experience--all this so that men will be precious to their country, dear to their friends, and happy within themselves.

Dora V. Smith wrote:

> It is the fashion these days to urge the schools to go "back to the 3R's" though it would be difficult for most of us to find one that has actually departed from them. What many of these critics want, as has already been illustrated, is that we should teach children accuracy in getting the thought from the printed page and leave until they are older any consideration of what has been said. Certainly accuracy in getting the thought is a fundamental end of the teaching of reading. Stopping there would furnish all the training necessary for a follower of Hitler, or Stalin, or Mussolini, who has but to grasp instructions in order to obey; but it is only the first step in the teaching of reading in a land where freedom of speech, we hope, prevails. Devotion to truth, learned through careful examination of ideas, is the aim of the teaching of communication in a democracy. Use of slanted or emotional language, fallacies in reasoning, stereotyped or prejudiced thinking, and substitution of the devices of propaganda for clear presentation of evidence must be recognized for what they are (22, pp. 19-20).
>
> ...Clearly, future citizens of the United States must be protected by their own training against the deliberate slanting of news and the cheap devices of propaganda.
>
> The temper of our times demands clear thinking in the face of malicious innuendo, hysterical pleading, false analogies, and, on occasion, deliberate misrepresentation of facts and principles of our country's heritage... (22, p. 22).
>
> In the face of this situation, it is clear that the schools must keep before the youth of the nation Kipling's (12, p. 213) challenge of fifty years ago:
>
> If you can keep your head
> when all about you
> Are losing theirs...you'll be
> a man, my son (22, p. 23).

Provided here is the yardstick by which every American teacher of reading should judge the children she teachers, her methods of teaching, and her objectives. Such is the resource of spirit and mind upon which sound reading instruction is premised. The struggle to make these principles prevail is the common challenge to all. This goal is what should be signified by the name: American Reading Instruction.

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